Abstract

A CNN uses convolutional steps to extract abstract features from an image. These features are fed into a fully connected neural network to classify and image based on what features were present. Since a CNN uses training data to learn, backpropagation is necessary. Each layer of the convolutional step needs to compute the gradient of the image features. Since, the gradient must be computed at each node, a modular approach eliminates the processes of calculating the entire loss gradient at once. With that being said, a CNN reduces the input space so much so, that the classifier will be processing an entire image over the span of a few parameters and additionally across a single chained gradient and loss. Since human neural networks don’t rely on the entire brain to recognize images – just sub regions – it would make sense to split the learning process across multiple convolutional agents which each analyze different portions on an image and calculate their own respective gradients. These agents can then conclude by way of voting, which image is presented.

Introduction

It’s important to consider that our brain makes decisions based on votes across many sub regions of the brain [1].

A proposed hypothesis is that if agents are tasked with classifying portions of an image instead of an entire image, then noise and adversarial data may be ignored, since the total loss from noise or an adversarial attack acts upon an entire image, and our agents vote on subsections, ignoring the total obfuscation of the data. An example: two convolutional agents inspect an image at different down sampling rates or dilations. Each network is inspecting a relatively similar image, but each use a different feature extraction approach. This ensures that the agents come to different conclusions at different times on different data – even though they are both looking at the same image. When it comes time to validate and vote on a classification, the closest agent to the desired goal is rewarded and the “genes” or parameters that succeeded are exchanged between not so successful agents. This process can be called reproduction and can generate a new agent which performs and learns by its influence on the previous successful generation.

[1] <https://link.springer.com/article/10.1007/s42452-021-04715-0>

Background and Benchmarks